Smith's Sound, large masses of free, undifferentiated, homogeneous protoplasm which contained no trace of the well-known coccoliths. On account of its truly Spartan simplicity, I called this organism, *which I was able to observe in the living state*, 'Protobathybius.' It will be figured and described in the Report of the expedition. I will merely state here that these masses consisted of pure protoplasm, with only accidental admixture of calcareous particles, such as formed the sea-bottom. They formed exceedingly viscid, net-like structures, which exhibited beautiful amœboid movements, took in carmine-particles as well as other foreign bodies, and showed active granule-streaming."

This is certainly a very deliberate and definite statement on the part of Dr. Bessels, who is a well-known and accomplished observer. It will be interesting to see how these observations can be reconciled with the view taken by Sir C. Wyville Thomson and Mr. Murray.

DINNER TO THE "CHALLENGER" STAFF

ON Friday last, Sir C. Wyville Thomson and other members of the *Challenger* staff were entertained at dinner in the Douglas Hotel, Edinburgh, by a large and distinguished company. Besides the civilian chief himself, the other members of the staff present were Mr. J. Y. Buchanan, Mr. J. Murray, Lieut. Balfour, Dr. Crosbie, and Paymaster Richards. The Lord Provost occupied the chair, the croupiers, as the vice-chairmen are called in Scotland, being Professors Huxley and Turner. The speeches were unusually happy and spirited, but we have space to give only a few quotations from that of Prof. Huxley in proposing the health of the scientific staff of the *Challenger*, and their director, Sir C. W. Thomson. After referring to previous Government expeditions for ocean exploration, Prof. Huxley pointed out that the peculiarity of the *Challenger* Expedition was that in her case the cruise became secondary and the scientific object primary; that she was, in fact, fitted up and instructed with the view of obtaining certain scientific data which were requisite for the further progress of natural knowledge. In her case the duty of geographical exploration was reduced to *nil*, and the duty of scientific investigation had become paramount.

After showing the great importance of a knowledge of the nature of the sea-bottom, Prof. Huxley went on—

"Thirty years ago it would have been absolute madness for anyone—I was going to say—to have hoped to obtain any knowledge of the nature of the sea-bottom or of the things which lived there at depths of 5,000, 6,000, 15,000, or 20,000 feet. But then here comes one of those admirable examples of the way in which the theoretical life of this world and the practical life interlock with one another, and interact with one another. Theoretical science, abstract investigation, carried on without reference to any practical aim whatever, that sort of abstract investigation which recent Acts of Parliament have endeavoured to throw a slur upon in this country, though I am happy to say that that has been removed in the House in which it originated—that kind of abstract investigation without immediate practical result, gave us the electric telegraph. When the electric telegraph was got, practical men desired to use it as a means of connecting remotely removed countries. For that purpose it was necessary to lay submarine telegraphs. For that purpose it was necessary to improve our means of sounding; and so out of the electric telegraph came those means of sounding at great depths of the sea, which have enabled us, for the first time, to bring up from the bottom, from a depth of two or three, or it may be four miles of sea-water, the actual things which are to be found at that enormous depth. That took place twenty years ago. In 1858, my friend Commander Dayman was engaged in the survey of the Atlantic for the purposes of the cable; and the Americans, who joined in the like service, had invented means by which specimens could be brought up from that depth. So that, if I may so say, ten years ago it was in the air to apply those new methods supplied by practical life to scientific purposes, to apply the methods of sounding, the methods of dredging, and the methods of ascertaining temperature which had been devised for the purposes of the telegraph engineer, to further investigation of the contents and nature of the sea. But it is all very well for ideas to be in the air. It needs clear brains to get them out of the air, and in this case there were two very clear brains at work on the subject—one of them the brain of our distinguished guest of to-night, Sir C. Wyville Thomson—and the other the brain of my friend Dr. Carpenter, who is well known to the scientific world."

Prof. Huxley then referred briefly to the history of recent deep-sea exploration and to the influences brought to bear on the Admiralty to send out the *Challenger*. He spoke of the object of the expedition and of the important results which have been achieved. "It was a very considerable task," he said, "it was a task which would have been absolutely chimerical thirty years ago, but it was a task which had been rendered possible, and which has been actually performed in the most satisfactory manner. The *Challenger* has brought home, I am informed, the records of such operations performed at between 300 and 400 stations—that is to say, at 300 or 400 points along that 70,000 miles, we know exactly the depth of the sea, the gradations of temperature, the distribution of superficial life, and the nature of what constitutes the sea-bottom; and such a foundation as that for all future thought upon the physical geography of the sea up to this moment not only had not existed, but had not even been dreamed of. I won't detain you by speaking of the great results of the expedition, for one very good reason, that I don't know them. They are in the breast of my friend at the opposite end of the table. But he has been good enough to favour us at the Royal Society from time to time with reports of what he has been about, and some of the discoveries which have been made by the *Challenger* are undoubtedly such as to make us all form new ideas of the operation of natural causes in the sea. Take, for example, the very remarkable fact that at great depths the temperature of the sea always sinks down pretty much to that of freezing fresh water. That is a very strange fact in itself, a fact which certainly could not have been anticipated *à priori*. Take, again, the marvellous discovery that over large areas of the sea the bottom is covered with a kind of chalk, a substance made up entirely of the shells of minute creatures—a sort of geological shoddy made of the cast-off clothes of those animals. The fact had been known for a long time, and we were greatly puzzled to know how those things got to be there. But the researches of the *Challenger* have proved beyond question, as far as I can see, that the remains in question are the shells of organisms which live at the surface and not at the bottom, and that this deposit, which is of the same nature as the ancient chalk, differing in some minor respects but essentially the same, is absolutely formed by a rain of skeletons. These creatures all live within 100 fathoms of the surface, and being subject to the fate of all living things, they sooner or later die, and when they die their skeletons are rained down in one continual shower, falling through a mile or couple of miles of sea-water. How long they take about it imagination fails one in supposing, but at last they get to the bottom, and there, piled up, they form a great stratum of a substance which, if upheaved, would be exactly like chalk. Here we have a possible mode of construction of the rocks which compose the earth of which we had previously no conception. But this is by no means the most wonderful thing. When they got to depths of 3,000 and 4,000 fathoms, and to 4,400 fathoms, or about five miles, which was the greatest depth at which the *Challenger* fished anything from the

bottom—and I think a very creditable depth too—they found that, while the surface of the water might be full of these calcareous organisms, the bottom was not. There they found that red clay so pathetically alluded to by my friend on the right [Commander Stewart, who replied for the Navy] as the material to which when glory called him he might be reduced. This red clay is a great puzzle—a great mystery—how it comes there, what it arises from, whether it is, as the director has suggested, the ash of foraminiferæ; whether it is decomposed pumice-stone vomited out by volcanoes, and scattered over the surface, or whether, lastly, it has something to do with that meteoric dust which is being continually rained upon us from the spaces of the universe—which of these causes may be at the bottom of the phenomenon it is very hard to say; it is one of those points on which we shall have information by-and-by. I will not detain you further with speaking of the matters of interest which have come out of this cruise of the *Challenger*; I will only in conclusion remind you that work of this kind could by no possibility be done without the zealous aid of an intelligent executive. That is the first condition, but our thanks have already been rendered to the executive officers of the *Challenger*. In the second place, it could only have been done by the aid of such a scientific staff, composed of picked men as was sent out in the *Challenger*, such men as Buchanan, Murray, and Moseley, and Wild, and Suhm; and I can hardly mention the name of the last gentleman without, in passing, lamenting that he alone of all the staff who left our shores,—he who certainly was the last person we should have imagined we should not see again—that a man of his accomplishments and promise and geniality and lovability should be the only one not to be welcomed back by the friends who loved him, and by the country which would have been glad to adopt him. But, again, a work such as has been done by the *Challenger* could only have been effectively carried out under the direction, not only of a man who intellectually knew what he was about, but whose moral qualities were such as to get the people with whom he was associated to work with him."

Prof. Huxley concluded by referring to the harmony which throughout prevailed among the staff of the *Challenger*.

"When men are shut up together in a limited society, whether it be a cathedral town or a ship, they begin to hate one another unless the bishop is a very wise person. In this case I do not doubt that the bishop was a very wise person, and I do not believe that the whole course of the *Challenger* afforded occasion for any such triangular duels as one hears of in the novels of Captain Marryat."

Sir C. Wyville Thomson made a suitable reply to the toast, giving a brief account of the various operations of the *Challenger*, and referring to the great amount of work yet to be done ere all the results could be given to the world.

PHOTOGRAPHIC PROCESSES[1]

IT is not my intention to enter into the history of any of the processes to which I propose to call your attention to-night, as I somewhat dread to enter upon such controversial ground. Probably the demonstration of the production of photographic prints by various methods will be of greater interest than any history.

Astronomy was the religion of the world's infancy, and it can hardly be a matter of surprise that untutored yet inquiring minds, unaided by any distinct revelation, should have attributed to the glorious orb, the centre of our solar system, the possession of divine attributes, and as they gazed upon the wondrous effects of his magical painting, that they should have offered to him their adoration and worship, and carefully noted any phenomena due to him. Thus probably the first photographic action noticed would be at a very early period of human existence, when the exposure of the epidermis to his rays caused what is known to us as tan, whilst the parts of the body covered would remain of their pristine whiteness. A photographic action which would be remarked at a later date would be the fading of colours in the sunlight. Ribbons, silks, curtains, and similar fabrics of a coloured nature undergo a change in tint when exposed to it.

I have here a specimen of a pink trimming used by the fair sex, and the lady who presented me with it informed me that it was "a most abominable take in," as the colour "goes" after two days' wear. Her ideas on the subject and my own somewhat differed, for to me it presented a capital opportunity of using the material as a means for obtaining a photographic print in a moderate time. I have here two results of the exposure of this stuff to the sunlight. One was exposed beneath a negative of an anatomical subject, and we have the image represented as white upon a pink ground. The other subject is a map. An ordinary map was superposed over a square piece of the stuff, and placed in sunlight whilst in contact. We have in this case the lines of the map represented as pink on a white ground, from which the colour had faded.

The general opinion is, I believe, that the colour is given off somewhat similarly to the scent from a rose. Were this entirely the case, the light would not act as it does, but beneath the negative or map, the colour would bleach uniformly. The bleaching seems to be a really chemical change in the dye due to the impact of light. There are many other bodies besides dyes which change in light, and some of them are of the most unlikely nature. I had intended to show you to-night the change that takes place in glass by exposure to light for long periods. My friend, Mr. Dallmeyer, has in his possession specimens of brown and flint glass, which have markedly changed colour in those halves of the prisms purposely exposed to solar influences. In some cases there is a "yellowing" of the body, and in others a decided "purpling."

It is, however, only those bodies which change rapidly in the light that are utilised in photography. The most common amongst these are various compounds of silver, for they are peculiarly sensitive to the action of light. Nearly every silver compound is more or less changed by it, and when I say changed I mean altered in chemical composition. When we reflect what light is we can better understand its action. Light, as experiment, confirmed by mathematical investigation, tells us, is caused by a series of waves issuing from the luminous source, not, indeed, trembling in our tangible atmosphere, but in a subtler and infinitely less dense medium, which pervades all space, and which exists even in the interior of the densest solids and liquids. These waves of ether, as this medium is called, batter against and try to insinuate themselves amongst the molecules of any body exposed to their action, a good many millions of millions of them impinging every second against it. Surely it is not surprising to think, small though the lengths of these waves be, that this persistent battering should in some instances be able to drive away from each of the molecules some one of the atoms of which they are composed.

Take as a type that salt of silver which was, perhaps, the first known to change in the presence of light-silver chloride. For our purpose we may represent each of its molecules as made up of two atoms of silver locked up with two atoms of chlorine. Let us consider the action of the light on only one molecule. The waves strike against it energetically and persistently; the swing that the molecule can take up is not in accord with the swing of the ether. It is shaken and battered till it finally gives up one atom of chlorine; the vibration of the remaining two atoms of silver and one of chlorine are of a different period, and are not sufficiently in discord to cause a further elimination of an atom. The molecule which contains the two atoms of silver and one of chlorine is called a sub-chloride of silver or argentous chloride, and is of a grey violet colour. If, then, I place silver chloride (held in position by a piece of paper) beneath a body, part of which is opaque and part transparent, and expose it to sunlight, I shall find that where the opaque parts cover it, there the white chloride will remain unchanged, whilst on the portions beneath the transparent parts, the dark silver sub-chloride will have been formed. Of course were the paper, after removal of the body, to be further exposed to light, the image obtained would disappear, as a blackening over the whole surface would ensue. In this state, then, the print is not permanent. Fortunately for photography, a ready solvent of silver chloride was

[1] Lecture by Capt. Abney, R.E., F.R.S., at the Loan Collection, South Kensington.